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Maintaining the Advantage

Ensuring Superiority in the Battlefield

In this edition of Army Space Journal, we continue with the theme of "Army Space – Sharpening Our Edge." As the Deputy to the Commander for Research, Development and Acquisition, I lead a team of dedicated professionals whose primary objective is helping our Warfighters maintain every possible advantage on the battlefield – allowing them to keep a technological "edge" over their opponents. We know that supporting the Warfighter means being creative, adaptive, and remaining constantly vigilant. Within Research Development and Acquisition, we are always looking for new ways to apply existing technologies, and evaluating emerging technologies for use on the battlefield.

It should surprise no one that the roles and responsibilities of each Soldier have evolved greatly over the past decade of war. Today's brigade combat team is called upon to support very large geographical areas of operations and to carry out diverse tasks as routine. On any given day, Soldiers from these teams might be simultaneously focused on targeting, tracking and locating a cell leader in a terrorist network, while providing security for VIPs or convoys and monitoring a potentially violent demonstration or responding to troops in contact.

In order to successfully carry out one, some, or all of these missions, a commander on the ground must make the appropriate time-critical decisions about how to allocate assets. Doing so requires persistent, assured, and responsive communications and intelligence, surveillance and reconnaissance coverage. A March 4, 2010 Operational Needs Statement from U.S. Army Forces Command highlights the need:

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Commercial handheld devices are so valuable that the Army is seriously looking at how they can be employed on the battlefield. This revolution in miniature electronics is now being extended into space, which equally has the potential to fundamentally alter some of our concepts of operations on the battlefield.

"The combat in Afghanistan is a platoon and squad fight, and it is necessary for these units to insert and extract by helicopter and to operate dismounted in isolated locations. Currently there are no systems that provide dismounted leaders access to all of the standard and non-standard ISR sources, COP and digital networks critical to their situation awareness."

– MG John F. Campbell, USA

Space-based communications and intelligence, surveillance and reconnaissance systems are an obvious solution to meeting the Warfighters' need for persistent, assured, and responsive coverage. Unfortunately, the costs associated with fielding space systems dedicated to the needs of the Soldier fighting at the platoon and squad level make it prohibitively expensive to field. Tactical satellite systems have potential, but to date have proven expensive to develop, and have required longer than desired lead times from concept to orbital insertion.

Because of the high cost and long lead time associated with traditional satellite systems, Research, Development and Acquisition is considering alternative solutions. We are currently evaluating the ability of nanosatellites to provide space systems capable of extending Army wireless communications via existing fielded devices and of providing intelligence, surveillance and reconnaissance support to the Soldier fighting at the platoon and squad level. Can nanosatellites provide intelligence and communications to previously unreachable forces? We're conducting technical demonstrations to find out.

Now we are not suggesting that these nanosatellites would replace large, bulk capacity systems. Our handheld electronic devices have not replaced desktop computers either, but they have produced an extraordinary and beneficial revolution in how we conduct our daily lives. Commercial handheld devices are so valuable that the Army is seriously looking at how they can be employed on the battlefield. This revolution in miniature electronics is now being extended into space, which equally has the potential to fundamentally alter some of our concepts of operations on the battlefield.

One of the obvious advantages of nanosatellites is their ease of development and relatively low cost. For cost comparison purposes, consider the Space Based Infrared System. The performance of this 10,000 pound satellite is nothing less than extraordinary, and it will become our Nation's primary means of early missile warning. Yet each system has a price tag of approximately $1.5 billion. It has been a decade in development, and changes to the system to accommodate new missions is inherently hard. The space community took a step forward in flexibility with the development of the 1,000 pound TacSat-3. It is less expensive, and less capable, but with "good enough" performance for some specific missions, with a price tag of around $88 million. Now consider Kestrel Eye, a 30 pound nanosatellite currently under development by our Research Development and Acquisition with our partners in Department of Defense and industry. Kestrel Eye is projected to cost around $1 million, and will provide visible imagery data. It takes advantage of the fact that commercial industry is producing radically improved digital cameras every six months. Even less expensive is the nine pound SMDC-ONE, a communications relay nanosatellite developed by our Research, Development and Acquisition element for around $350,000 a copy.

The same case made for unmanned aerial vehicles could be made for nanosatellites. Unmanned aerial vehicles are far less capable than an F-16, but they are a useful additional "tool in the toolbox." Because of their lower price you can build more of them, and then chop them to lower levels of command. Similarly, for the price of one Space-based Infrared System, you could purchase 17 TacSat-3 equivalents. And a constellation of 27 SMDC-ONE nanosatellites could provide fairly good persistence for a specific mission to a dedicated customer for only about $9.5 million. Nanosatellites are not as capable, but the tasking and direct data reception will be owned by the Soldiers

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in the field who need the capability the most, as opposed to the larger, bulk service satellites that must be centrally controlled. The technology revolution that has put new capability in our hands and changed our lives will make space assets both more responsive and affordable.

Beyond cost, other appealing aspects of nanosatellites are their ability to adapt faster than the enemy, and their resiliency. Just like a cell phone, you can afford a new one every few years to keep up with the changing technology. This will help us better combat an adaptive enemy. And as the threat of space becoming a contested environment increases, constellations of nanosatellites are more resilient against the growing threat.

To further put things in perspective, Space-based Infrared Systems will take around 16 years to go from program start to completion of the first satellite. TacSat-3's modular satellite bus was developed in 15 months after contract award, and the payload was developed in 18 months. Getting the system integrated and launched took another two years. Still, from concept to orbit in around five years is considerably more responsive than a 10 to 15 or so year lead time. SMDC-ONE went from concept to delivered nanosatellites (eight in total) in less than a year.

So far, our nanosatellite demonstrations have proven that the time required for fielding a space system can be significantly reduced. Some of the time reduction occurs because the requirements (or missions) the satellite is designed to meet are limited. Other reductions in production time occur through the use of a common bus and power supply, and by reducing redundancy and survivability requirements. Given the relatively low cost and ease of replacement, our approach is to develop satellites with an expected life span of months instead of the customary decade or more designed into major satellite acquisition efforts. Our objective is to meet the current needs of the Army, and we recognize requirements will evolve from year to year.

By emphasizing interoperability with existing ground equipment, we also significantly reduce the logistics tail and personnel requirements associated with fielding a nanosatellite system. The nanosatellites we're developing don't require unique and/or expensive ground terminals that must be developed, tested, and fielded before the capability can be used by Soldiers in the field. Using the hardware and applications the Army currently has on hand significantly reduces training requirements; again reducing costs.

Our approach, using a common bus capable of supporting multiple payloads or packages and going from concept to production in a year or less, allows for frequent technology hardware and software updates. Most major space system acquisitions must make technology decisions during the design phase – often more than a decade before the satellite is actually manufactured. Doing so limits the space system to ten-year-old technology solutions on board the spacecraft and often on the ground systems developed to work with the satellite as well. With nanosatellites, our technology is usually no more than two to three years old and can be updated as needed.

Responsiveness is another attribute of nanosatellite systems. Because of the short lead time from concept to satellite, we would be able to quickly respond to the evolving needs and missions of the Warfighter. Taken to its logical conclusion, nanosatellite technology will allow us to develop and have ready various payloads which can be quickly integrated onto a standard satellite bus and delivered for launch. This ability to rapidly respond to short-notice tasking, coming directly from the theater, will allow for the development of space-based communications and intelligence, surveillance and reconnaissance systems that are persistent and adaptive to evolving missions.

SMDC-ONE, launched Dec. 8, is the first Army satellite launched since October 1960. The satellite is flying as a secondary payload on the delivery vehicle, and will be deployed in a low, short-lived orbit for around 30 days. During the satellite's 30 day lifespan, the first step will be to demonstrate military utility for nanosatellites and evaluate the ability of nanosatellite technology to augment traditional capabilities. Lessons learned from the demonstration will be used to further our analysis and military utility of such nanosatellites.

In conclusion, Research, Development and Acquisition is working to find solutions for meeting the Warfighters' need for persistent, assured, and responsive communications and intelligence, surveillance and reconnaissance coverage. Nanosatellite technology appears to be one solution for meeting this objective. We have developed one nanosatellite system and are in the process of developing others in conjunction with other Department of Defense organizations. Within Research, Development and Acquisition, our focus is on meeting the needs of the Soldier – working to assure a continued technical superiority on the battlefield.